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THE FUTURE
OF
USAF COMBAT SEARCH AND RESCUE

BY
TIMOTHY J. LEAHY

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It is my wife, Kathy, and daughter, Shannon, who I would like to thank most. They sacrificed my presence at night and on the weekends, for the second year in a row, so that I could pursue academic endeavors. Only time will tell if the benefit will justify the sacrifice.

About The Author

Major Timothy J. Leahy graduated from The Citadel in 1985 and was commissioned in the United States Air Force through the Reserve Officer Training Corps program. He attended Undergraduate Pilot Training-Helicopter at Fort Rucker, Alabama, where he graduated with honors. His first assignment was flying HH-3s for the Air Rescue Service as a combat search and rescue pilot in Alaska. In 1989 he was selected to transition to the Special Operations MH-53J Pave Low IIIE at Hurlburt Field, Florida. While there he served as aircraft commander, instructor, flight examiner, and Assistant Director of Operations for the 20th Special Operations Squadron. Major Leahy has over 2500 flying hours including combat time in Iraqi, Haiti and Bosnia-Herzegovina. He has a bachelor's degree in Business Administration from The Citadel, a master's degree in International Relations from Troy State University, and a master's degree in National Security and Strategic Studies from the US Naval War College. Upon graduation from the School of Advanced Airpower Studies, Major Leahy will be assigned as an exercise and plans officer in the special operations division of EUCOM, Stuttgart, Germany.

Abstract

The genesis of this paper is based on the following concept. The need to recover isolated personnel quickly and reliability raises many policy issues about U.S. combat air search and rescue forces, not the least of which relate to the suitability of their aircraft fleet. Along these lines, this study asks the question of whether the USAF should be satisfied with its helicopter-based CSAR force for the indefinite future, or whether it should make definite plans to replace those helicopters expeditiously with tiltrotor aircraft, probably the Bell-Boeing V-22 *Osprey.*

The first part of this paper analyses the role CSAR has played in the Air Force's past and the current and future requirements of USAF CSAR forces. The conclusions reached are that both historically in times of conflict and in today's operational environment a requirement existed and will continue to exist for CSAR capabilities. Additionally, the need to react quickly over greater distances will impact the structure of tomorrow's CSAR forces.

The second part of the paper analyses the impact of speed, range and survivability on the success or failure of rescue operations through the use of three case studies. The case studies indicate that in varying degrees both the planning and probability of success of rescue missions are influenced by the effects of speed, range and survivability. From a strict operational viewpoint, an aircraft that has increased speed, range and survivability would be more flexible and capable in the CSAR mission.

The second part of the paper analyses the impact of speed, range and survivability on the success or failure of rescue operations through the use of three case studieWhile this overview indicates that it is conceivable that a CSAR fleet of tiltrotor

aircraft would yield long-term cost savings over a helicopter and C-130 based fleet, it also indicates that a comprehensive cost-benefit analysis is justified before the final decision is reached to determine if the V-22 should replace current CSAR aircraft.

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Chapter 1

USAF CSAR: Past, Present, Future

One of the things that war leaves in its brutal wake is the memory of acts of courage undertaken to save human life in the midst of so much taking of life.

Howard Sochurek

National Geographic

Introduction

The military operational requirements of the post-Cold War era create situations where American servicemen and even civilians can become isolated from the control and protection of their main forces. While the overall size of the U.S. military has been reduced, the use of military and civilian personnel to support United Nations peacekeeping and peace enforcement operations has increased. Whether enforcing no-fly zones, combating state-sponsored terrorism, conducting famine relief or suppressing drug traffickers, U.S. personnel are being placed in harm's way to a greater extent than during the Cold War. The expanded use of U.S personnel in areas outside the traditional, structured, American military setting increases the potential for these forces to become isolated and require assistance.

Apart from moral considerations, the quick and reliable recovery of these isolated personnel can be a matter of great political and diplomatic importance. As the frequency of American military involvement increases in areas that previously have been considered devoid of vital national interests, the American people's willingness to accept casualties has diminished. The political decision to withdraw U.S. forces from the United

Nation's operation in Somalia, following the death of American servicemen, is one example of the profound effect a few casualties can have on U.S. policy. Additionally, both U.S. and Iraqi leaders believed that a high American casualty rate in the Gulf War would erode U.S. public support and force a withdrawal.

The need to recover isolated personnel quickly and reliability raises many policy issues about U.S. combat air search and rescue (CSAR) forces, not the least of which relate to the suitability of their aircraft fleet. Along these lines, this study asks the question of whether the USAF should be satisfied with its helicopter-based CSAR force for the indefinite future, or whether it should make definite plans to replace those helicopters expeditiously with tiltrotor aircraft, probably the Bell-Boeing V-22 *Osprey*.

To determine if the Air Force should replace its rescue helicopters with the V-22 this paper will analyze the role CSAR has played in the Air Force's past, the current and future requirements of USAF CSAR forces, and the effect of speed, range and survivability on the success or failure of rescue operations. Additionally, the proposed benefits and costs of the V-22 will be outlined for comparison to current CSAR aircraft. The last chapter offers some conclusions and makes some recommendations as to factors that should be considered to provide the most capable CSAR force in the 21st century. The purpose of this paper is to inform military planners involved with restructuring the post-Cold War Air Force as to the relative importance of CSAR and the factors to consider in building the CSAR force of tomorrow.

Therefore, the methodology of this study involves a discussion of history, doctrine, vision and experience. History to assess the role CSAR played in the past and how the USAF fulfilled its share of that role. Joint and Air Force Doctrine to determine the requirements that govern CSAR forces today and if those requirements are being satisfied. Global Engagement, the Air Force vision for the 21st century, to determine the requirements that will govern the CSAR forces of tomorrow. Case studies keyed to operational requirements to determine the effect of speed, range and survivability on CSAR missions. Finally, a cost-benefit overview of the V-22 is included so that the reader can make his own judgment as to the benefits of tiltrotor technology.

It bears mentioning that there are other issues that will impact on the structure and capability of the CSAR force of tomorrow. These include the requirement for a

peacetime search and rescue capability and the current force structure policies that concentrate CSAR forces in Air Force Reserve and Air National Guard units. Additionally, the nature of the threat, the actual funding available and the percentage allocated to CSAR, compatibility with other force elements, Congressional and industry interests and interservice politics all must be considered in building the force of tomorrow. However, these issues are beyond the scope of this paper and are not central to the operational analysis being conducted.

Since the focus here seeks lessons from the past to apply in the future, certain assumptions must be made for the analysis to be valid. The first assumption is that the development, production and delivery of the V-22 will continue according to schedule and when it enters service, it will perform as anticipated. The second assumption is that the range, speed and survivability increases of the V-22 over current and proposed helicopter designs as reported in the Institute for Defense Analyses 1990 report, *Assessment of Alternatives for the V-22 Assault Aircraft Program* are correct.[1]

Background

> *I am waiting with earnest expectation the first time that an aeroplane actually saves a life; when that takes place, it will have conquered the heart of the people as well as fascinated its intellect, aroused its awe, or compelled its admiration.*
>
> Glenn H. Curtiss
> The Curtiss Aviation Book

The history of combat search and rescue illustrates its importance to American military capabilities. However, in peacetime this capability is often overlooked or marginalized. Although, arguably there are some instances of air rescue operations before WW-II, CSAR, as we understand it today began with that war.

World War II

> *The rescue of one highly trained airman not only saved his life, but also the time and expense of training his replacement.*

[1] Dean L. Simmons, *Assessment of Alternatives for the V-22 Assault Aircraft Program (U),* IDA Report R-371 (Alexandria, Virginia: Institute for Defense Analysis, 1990), p. 1-24.

The German air sea rescue service, *Sceenotdienst*, entered the Second World War as the most capable CSAR force. The Luftwaffe lost 1733 aircraft destroyed and 543 others damaged in the Battle of Britain.[2] During the Battle the Germans established the merits of CSAR in their ability to rescue airman downed over the English Channel. The Germans had some thirty Heinkel 59 floatplanes configured for search and rescue at sea and equipped their aircrews with fluorescent sea-dye and inflatable dinghies. However, the Germans could not garner the full benefit of their CSAR capabilities when the British accused the German CSAR aircraft of intelligence gathering and started attacking them.

The British lost 213 Hurricane and Spitfire aircraft between the eighth and the eighteenth of August 1940 with slightly over one hundred produced.[3] Concurrently, the Royal Air Force lost "154 pilots killed, missing and severely wounded; and the number of new fighter pilots produced during the same period was only 63."[4] This diminishing supply of pilots, many lost over the English Channel, became a catalyst to improve the capability to rescue airmen at sea for both humanitarian reasons and as a means to recover a critical military resource. The British CSAR helped stem the tremendous drain on pilots.

At the beginning of the war the United States Army Air Corps possessed no organized search and rescue force. Prior to the war search and rescue was the responsibility of each local commander, using organic aircraft with no organized operational guidance or training.[5] When American aircraft started to fly from England, "the British had already developed Air Sea Rescue to a fine art."[6] The Americans would follow the British lead and in December of 1943 the first of several Emergency Rescue Squadrons (ERS) was activated and sent to Europe.[7]

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[2] Captain Norman MacMillan, *The Royal Air Force in the World War* (London: George G. Harrap & Co., Ltd., 1950), p. 10.
[3] Dennis Richards, *Royal Air Force, 1939-1945*, vol. I, *The Fight at Odds* (London: Her Majesties Stationery Office, 1953), p. 175.
[4] Ibid., p. 176.
[5] Frank E. Ransom, *"Air-Sea Rescue, 1941-1952"* (US Air Force Historical Study No. 95, Research Studies Institute, Air University, Maxwell AFB, Alabama, 1954), p. 1-3.
[6] Major Charles D. Fraser, "Mayday!, Mayday!, Mayday!", *Air Force*, January 1945, p. 19.
[7] Ransom, p. 5.

World War II necessitated the deployment of combat aircraft long distances over water. However, "little consideration had been giving to the search for, and retrieving of, missing or crashed airmen."[8] By the end of the war the Army Air Corps, U.S. Navy and their British counterparts rescue assets had saved nearly 5000 lives.[9] Although air sea rescue organizations had come a long way they were still deficient in the ability to rescue airmen over land. However, in the China-Burma-India Theater a new device had been tested that foreshadowed the future of CSAR. It was the helicopter and had the capability to retrieve downed airmen from the sea and from remote sites on land.

Korean Conflict

In the aftermath of WW-II Lieutenant General Hoyt S. Vandenberg recommended that all Army Air Corps rescue functions be transferred to the Air Transport Command (ATC) and that ATC be directed to accomplish the following mission:

> *...establish and maintain a land-air search and rescue organization within the United States and sea-search and rescue agencies along ATC foreign routes, organize mobile rescue squadrons for assignment to each theater air command, and establish liaison with Coast Guard commanders for continental search and rescue.*[10]

On 13 March 1947 Vandenberg's recommendation became formalized with the creation of the Air Rescue Service (ARS) under the Air Transport Command.[11] The focus of the Air Rescue Service was in support of long range over-water coverage for strategic bombers and transport aircraft which resulted in a force composed mainly of amphibians and lifeboat planes. The few helicopters in the ARS inventory were used in a limited, local area, rescue role.

As the conflict in Korea began the United States Air Force required a rapid build-up in tactical air forces to support the beleaguered ground troops. In order to support the tactical air forces new air rescue tactics and procedures were needed.[12] H-5 helicopters

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[8] Kight, app.20, p. 2.
[9] Earl H. Tilford, Jr., *Search and Rescue in Southeast Asia, 1961-1975* (Washington D.C.: Office of Air Force History, 1980), p. 8.
[10] Ransom, p. 148.
[11] Donald B. Little, *Aerospace Rescue and Recovery Service, 1946-1981: An Illustrated Chronology* (Office of MAC History, Scott AFB, Illinois, 1983), p. 1.
[12] General Otto P. Weyland, 'The Air Campaign in Korea", *Air University Quarterly Review*, Fall 1953 p. 3-28; and "Tactical Air Rescue in Korea", *Air University Quarterly Review*, Fall 1953, p.120-123.

from the 3rd ARS, headquartered in Japan, deployed to Korea and began what became the standard practice of conducting rescue missions for downed airmen behind enemy lines.[13]

The ARS helicopter's that had been relegated to a limited role in support of the strategic air forces, became the centerpiece in support of the tactical air forces engaged in the Korean conflict. By the time the conflict ended the helicopter had emerged as the primary combat rescue vehicle in the Air Force inventory.

It was apparent that "in the future--as new search and rescue equipment was produced and rescue units gained the ability to penetrate deeper into enemy territory--a larger search and rescue force would be required to support a tactical air force in combat.[14] The Korean conflict saw ARS increase in size to 11 groups and 41 squadrons by November 1952, mainly in support of the tactical air forces.

As the Korean conflict came to an end the American military repeated its traditional rapid downsizing. ARS fell from its 50 squadron high of 1954 to only 11 squadrons in 1961.[15] The focus of the rescue mission returned to covering over-water routes with fixed wing aircraft in support of strategic bombers. Helicopters were relegated to humanitarian, peacetime-only missions but the H-3 evolved to support the fledgling space program. As the United States became involved in Vietnam it would be the H-3 that emerged as the initial CSAR workhorse.

Vietnam

> *When the history of the war in Vietnam is finally written, the story of Air Rescue may well become one of the most outstanding human dramas in the entire history of the Air Force.*
>
> Secretary of the Air Force Harold Brown
> Aerospace Historian

The focus of U.S. defense policy, following the Korean Conflict returned to that of strategic nuclear deterrence. In that the Korean Conflict was viewed more as an

[13] Robert Frank Futrell, *The United States Air Force in Korea, 1950-1953* (New York: Duell, Sloan and Pearce, 1961), p. 536-537; and "Tactical Air Rescue in Korea", op. cit., p. 121.
[14] Futrell, p. 543.
[15] Tilford, p. 15.

aberration that as a template for future wars, the force structure to support this type of war was reduced. Therefore, USAF doctrine during the 1950's endorsed training and equipment focused on strategic nuclear forces and the delivery of nuclear weapons in both general and tactical warfare.[16]

In lieu of this doctrine the need for tactical air forces, and the rescue helicopters that supported them, were viewed as a remote possibility. The ARS mission returned to supplying peacetime rescue support for Air Force operations and its mission statement went so far as to exclude the requirement for aircraft and training designed for conducting CSAR.[17] Rescue resources were reduced to an all-time low with only three squadrons remaining in ARS by the end of 1960.[18]

As USAF airmen began to fly operational missions in Vietnam, during operation FARM GATE in 1961 the need for CSAR surfaced. The activation of Detachment 3, Pacific Air Rescue Center at Tan Son Nhut with no assigned aircraft began combat rescue in the Vietnam Conflict.[19] Because ARS did not have a wartime tasking, there were no standard rescue procedures, no equipment designed for CSAR, and no units trained to conduct CSAR. Additionally, since FARM GATE was billed as a training mission, the deployment of fully equipped CSAR forces could highlight the politically sensitive fact that Americans were actually engaged in direct combat operations.[20]

As American involvement in Vietnam increased so to did the size and capability or the rescue forces. The amphibious HU-16 and non-amphibious HC-54 were replaced by the larger and more capable HC-130. The first ARS helicopter deployed to Southeast Asia the HH-43 was replaced by the more capable HH-3 Jolly Green Giant and later the HH-53 Super Jolly Green Giant, both of which were air refuelable and had the range to reach any point in North Vietnam. The A-1E Skyraider and later the A-7 Corsair began flying protective escort for the helicopters.

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[16] Col. Dennis M. Drew, "Two Decades in the Air Power Wilderness: Do We Know Where We Are?", *Air University Review*, September-October 1986, p. 4-5.
[17] Tilford, p. 16.
[18] "The Military Airlift Command--A Brief History" (Office of MAC History, Scott, AFB, Illinois, 20 April 1977), p. 37.
[19] Carl Berger, ed., *The United States Air Force in Southeast Asia, 1961-1973: An Illustrated Account* (Washington D.C.: U.S. Government printing Office, 1984), p. 235.
[20] Tilford, p. 37.

The rescue package that was assembled to recover downed airman became known as the Search and Rescue Task Force (SARTF). The only factors limiting the size of the armada, the rescue controller could assemble into a SARTF, was the number of available resources and the controller's skill in assembling, coordinating and controlling these resources. It was not uncommon to divert strike aircraft or task Navy ships to supply firepower to the SARTF or task the ships to accomplish the rescue at sea.

Rescue forces saved 3,883 lives of which 2,780 were under combat conditions in Southeast Asia. In doing this 45 rescue aircraft and 71 rescue personnel were lost.[21] Colonel Paul E. Leske, commander 3rd ARRGp, sums up the rescuemen's mentality.[22]

> *When a man is downed, he is far more than a statistic. He is a fellow American, with a family at home, with hopes and dreams and a potential that cannot be measured. He is a man in trouble, and he needs help fast.*

The Rise of Special Operations

Following the Vietnam War CSAR forces were again reduced in size. By 1977 the Aerospace Rescue and Recovery Service (ARRS -name changed during Vietnam) had been reduced by 35% from its wartime high of 1971.[23] However, unlike the previous rescue force reductions, this time ARRS maintained a mission focused on CSAR.

> *The Primary mission of ARRS is Combat Rescue...The primary objective of the ARRS Forces...is the preservation of one of the nation's most critical resources, Combat Aircrew Members...This mission demands an integration of various systems and capabilities into a cohesive and highly responsive force specifically equipped and trained to operate and survive in the hostile environment.*[24]

The CSAR focus of ARRS allowed it to capitalize on the lessons learned from Vietnam to anticipate the type of capabilities it would require to be effective in the next conflict. The scope and tempo of the air war in Vietnam had allowed hundreds of strike missions to be diverted from their primary mission to support rescue operations. Moreover, the slow moving helicopters were highly vulnerable to ground fire and were

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[21] Little, p. 24; and Berger, p. 243.
[22] Quoted in Sochurek, p. 349.
[23] "The Military Airlift Command--A Brief History", p. 38.
[24] U.S., Department of the Air Force, *Airborne Mission Commander (AMC) Training and Qualification Regulation* (ARRS Regulation 51-4, HQ ARRS (MAC), Scott AFB, Illinois, 25 March 1980), p. 38.

dependent on escort to accomplish daytime rescue missions. Therefore, since rescue forces could not depend on this level of support in the next conflict, helicopter survivability became a great concern.

Developing a new rescue aircraft was not a high priority in the Air Force budgets of the late 1970's. However, the Air Force did conduct tests to determine the feasibility of upgrading the HH-53 fleet to a configuration that allowed low altitude, night, adverse weather flight known as Pave Low III. The Air Force approved the modification of nine HH-53s to Pave Low III configuration to be completed by 1980.[25] However, on 24 April 1980 with the failure of the mission to rescue the hostages held in Iran, the emphasis quickly shifted away from increasing CSAR capability and onto increasing special operations capabilities.

All the Pave Low III modified HH-53s and eventually all the HH-53s, as they were modified, were transferred to special operations. ARRS was left with a mostly obsolete, hollow force that was capable of peacetime only missions. However, JCS Pub 3-05.2 required each service and component to provide to the joint force commander its own forces to conduct CSAR.[26] As of January 1991 the Air Force effort to rebuild its CSAR forces had resulted in one active duty unit of HH-60 Blackhawk helicopters and HC-130 tankers.[27]

The Gulf War

The Air Rescue Service (ARS) did not possess a sufficient number of HH-60s or trained crews to deploy to the Gulf War. ARS (name changed back in the inter-war years) did not have the force structure to recover the forecast 40 aircraft per day losses estimated for the initial operations of the war.[28] Therefore, the Air Force Special Operations Command (AFSOC) with its Pave Low IIIE helicopters was tasked to provide theater CSAR coverage.

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[25] Little, p. 52-59.
[26] *Doctrine for Joint Combat Search and Rescue (CSAR),* Joint Publication 3-05.2, 20 December 1991, p. I-2.
[27] *Gulf War Air Power Survey, Volume IV,* (Unclassified Edition), Government Printing Office, Washington D.C., 1993, p. 300.
[28] *Gulf War Air Power Survey, Volume IV, p. 301.*

ARS, which has the primary mission of CSAR for the Air Force, had been allowed to wither to the point that it was incapable of conducting the mission. AFSOC with its collateral CSAR mission did not have crews previously trained or equipped for theater CSAR prior to the start of the Gulf War.[29] Consequently, of the 64 total downed crewmembers during the Gulf War only three were rescued.[30] The USAF did not possess a capable CSAR force upon entry into the Gulf War. The short duration of the war and relatively low shootdown rate did not generate an urgent need to overcome the problem.

Bosnia-Herzegovina

Following the Gulf War, ARS was able to deploy rescue forces to Kuwait to provide CSAR for Operation SOUTHERN WATCH. However, when the USAF became involved with combat operations in the former Yugoslavia, ARS did not have the forces to support both theaters. Therefore, in Bosnia-Herzegovina, AFSOC once again was tasked to provide theater CSAR coverage. The Air Force still did not possess the ability to supply dedicated CSAR assets to the joint force commander.

CSAR has historically and doctrinally been a 24-hour a day operation, requiring both night and day capabilities.[31] However, special operation forces (SOF) are designed, equipped and trained to operate primarily at night in order to penetrate a higher level of threat.[32] This requires SOF to make a fundamental change in how they plan to conduct CSAR or the joint force commander to accept a gap in CSAR coverage during the day.

The low threat to allied aircraft in Bosnia-Herzegovina, combined with the USMC ability to provide daytime theater CSAR coverage, when an Amphibious Ready Group (ARG) was in the area, has allowed this problem to remain out of sight. However, if the situation in Bosnia-Herzegovina changes or if the threat in the next conflict is greater, the lack of a dedicated CSAR force will be more serious.

Towards the Future

Still the question recurs 'can we do better?' The dogmas of the quit past

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[29] *Gulf War Air Power Survey, Volume IV, p. 311.*
[30] Richard Hallion, *Storm Over Iraq: Air Power and the Gulf War,* Smithsonian Institute Press, Washington D.C., 1992, p. 246.
[31] *Gulf War Air Power Survey, Volume IV, p. 300.*
[32] John A. Hill, "AFSOF: A Unique Application of Aerospace Power", Research Report, Air University Press, Maxwell Air Force Base, Alabama. April 1993, p. 12.

are inadequate to the stormy present. The occasion is piled high with difficulty, and we must rise with the occasion. As our case is so new, we must think anew, and act anew.

Abraham Lincoln
Global Engagement

Standing U.S. doctrines mandate the maintenance of CSAR capabilities within all services. "Joint Pub 3-50.2, doctrine for joint combat search and rescue, provides guidance and procedures necessary to plan, coordinate and conduct a timely and tailored joint CSAR response across the range of military operations."[33] The guidance in this pub is authoritative and states that, "each Service and the US Special Operations Command are responsible for performing combat search and rescue (CSAR) in support of their own operations."[34] Air Force Basic Doctrine Document 1 refers to CSAR as "an integral part of U.S. combat operations and must be considered across the range of military operations."[35] It continues to say, "it is a key element in sustaining the morale, cohesion, and fighting capability of friendly forces."[36]

In the USAF, major commands (MAJCOMs) are responsible for organizing, training, equipping, sustaining and providing operational ready forces for CSAR. Air Combat Command (ACC) is the lead agent for all the USAF's Combat Air Forces (CAF) rescue forces and is responsible for providing CSAR capability to the JFC.[37]

USAF helicopters capable of conducting CSAR operations for the JFC differ in both capabilities and command relations. The current USAF rescue aircraft, the HH-60G, is capable of operating only in a low to medium threat environment.[38] However, according to Joint Pub 3-50.2 the most capable CSAR aircraft in the USAF inventory, the MH-53J, has the mission of conducting special operations and is under the control of the SOF commander.[39]

Global Engagement: A Vision for the 21st Century Air Force outlines an USAF that must be capable of conducting combat operations increasingly from the Continental

[33] Joint Pub 3-50.2, Doctrine for Joint Combat Search and Rescue, 26 January 1996, p. i.
[34] Ibid., vii.
[35] *Air Force Basic Doctrine*, Air Force Doctrine Document 1, September 1997, p. 60.
[36] Ibid.
[37] Ibid., p. D-2.
[38] Ibid., p. D-3.
[39] Ibid., p. D-3.

United States (CONUS).[40] It calls for an Air Force that uses speed and global range to achieve "Full Spectrum Dominance".[41] It seeks to build an air force that uses highly responsive and agile forces to meet the combat needs of the 21st century.[42]

Implications

The historical analysis indicates that in times of conflict CSAR capabilities always have been required. However, the training and equipping of CSAR forces has never been a high priority for the peacetime Air Force. Joint Doctrine tasks the Air Force to provide CSAR capability to the JFC in support of USAF operations and Air Force Doctrine recognizes the requirement for and benefits associated with CSAR forces. However, neither Joint nor Air Force Doctrine establishes capability criteria that a CSAR force must satisfy. Hence, an Air Force CSAR force-in-being satisfies the doctrinal requirements of performing combat search and rescue in support of USAF operations.

Yet, today's military operational requirements create situations that increase the likelihood of American servicemen and even civilians becoming isolated and in need of a quick and reliable CSAR force more probable. Additionally, the need to quickly and reliably recover these isolated personnel can be a matter of great political and diplomatic importance. Therefore, with the Air Force vision for the 21st century calling for an agile, fast, global ranged Air Force capable of conducting operations from CONUS bases, the current CSAR force approaching the end of its forecast service life and the arrival of tiltrotor technology, all suggest that now is a good time to consider CSAR force structure.

Since its inception the unique capability of the helicopter to takeoff and land vertically and hover over a point on the ground has made it a valuable rescue asset. However, its aerodynamics has restricted its range, speed and service ceiling, thereby limiting its survivability. Tiltrotor technology, currently embodied in the V-22 *Osprey*, has overcome many of the range, speed and survivability problems inherent with helicopters.

The maximum attainable speed of a helicopter is restricted to approximately 200 knots indicated airspeed due to the theoretical limits imposed on rotary-wing

[40] Global Engagement: A Vision for the 21st Century Air Force, p. 5.
[41] Ibid., p. 7.

aerodynamics by the laws of physics. This speed constraint has limited both the range and survivability of helicopters. The US Navy, USMC and US Special Operations Command are all acquiring the V-22 to replace their helicopters that have performed missions requiring similar capabilities to USAF CSAR aircraft.

Therefore, the remainder of this paper will evaluate the effect speed, range and survivability have had on the success or failure of rescue missions in the past. Based on the results of the case studies, the history of CSAR in the Air Force, doctrine and *Global Engagement*, conclusions will be reached and recommendations given to answer the following question. Should the USAF be satisfied with its helicopter-based CSAR force for the indefinite future, or should it make definite plans to replace those helicopters expeditiously with tiltrotor aircraft, probably the Bell-Boeing V-22 *Osprey*.

[42] Ibid., p. 16.

Chapter 2

Son Tay Prison Raid

The raid on Son Tay is an example of the use of rescue forces to conduct a deliberately planned and rehearsed mission. The mission had strategic implications and highlighted the utility of CSAR forces. During the mission range and survivability factors proved to be enablers that allowed the mission to be conducted but speed turned out to be the dominant CSAR aircraft capability upon which much of the operation hinged.

Background

The Son Tay prison camp was located twenty-three miles west of Hanoi, North Vietnam, in an isolated, rural part of the country on the bank of the Song Con River. In 1969 the North Vietnamese decided to enlarge the camp through the use of Prisoner of War (POW) labor.

The origins of the rescue operation lay mainly in the actions of two American airmen. On the night of 9 December 1969, more than two years after being shot down, Major Elmo "Mo" Baker and Captain Larry Carrigan, were transferred from Hoa Lo Prison (the so-called "Hanoi Hilton") to San Tay Prison.[43] Shortly after arriving, the airmen realized that, while they were in an isolated part of the country and that escape was next to impossible, several seriously ill prisoners were held at Son Tay."[44] If these men did not get medical attention soon they would most likely die. Baker does not remember who first came up with the plan, but a plan to signal for a rescue was devised.[45]

[43] Richard Harris, "Raid at Son Tay", *American History Illustrated*, 25 March/April 1990, p. 59-60.
[44] Ibid., p. 60.
[45] Ibid.

The POW's used two methods to signal for a rescue. Unnoticed by the guards, they laid out their laundry to form the letters "S A R" (Search and Rescue).[46] Additionally, the POW's stacked rocks around the compound signaling in Morse Code that six men were going to die if they did not get medical attention fast.[47]

Fortuitously, USAF reconnaissance technicians quickly detected the signals. Technical Sergeant Norval Clinebell, a photointelligence specialist assigned to search for POW camps, saw the letters on SR-71 reconnaissance photos.[48] He also knew that the letters "S A R" could only be a signal for a rescue mission, Clinebell passed the word up channels. News of the presence of prisoners at Son Tay moved up channels quickly. The Son Tay message eventually reached Army Brigadier General Donald Blackburn, commander of the secret Pentagon office of the Special Assistant for Counterinsurgency and Special Activities (SACSA).[49] Seeing an opportunity, Blackburn and his staff studied the feasibility of conducting a rescue mission for the POW's at Son Tay and determined it was possible. However, SACSA did not have the authority to authorize a rescue mission, only the Chairman Joint Chiefs of Staff (CJCS) or higher could authorize such a mission.[50] Admiral Thomas H. Moorer, CJCS, was briefed privately on the possibility of conducting a POW rescue mission by SACSA. He gave preliminary approval for the mission and authorized Blackburn to assemble and train a task force capable of conducting the mission.[51]

Preparation

Admiral Moorer lost no time in selecting his senior commanders for the operation. USAF Brigadier General LeRoy J. Manor, Commander USAF Special Operations Forces, and Army Colonel Arthur D. "Bull" Simons, G-4 for the US Army XVIII Corps, were summoned privately to the Pentagon and directed to report to the

[46] Ibid., p. 60-61.
[47] Ibid., p. 61.
[48] Ibid.
[49] Ibid.
[50] Ibid.
[51] Ibid.

CJCS.[52] Admiral Moorer asked Manor and Simons "if they were prepared and willing to take on an assignment to explore the feasibility of attempting to rescue some US POW's held by North Vietnam--with the ultimate responsibility of conducting the operation if it be deemed feasible."[53] Both men immediately answered yes, and Gen Manor was appointed as commander and Col Simons as his deputy.

General Manor and Simons next assembled a volunteer rescue force under conditions of great secrecy. The Secretary of Defense, Mr. Melvin Laird, had authorized the assembly and training of a rescue force and given them carte blanche for any resources required.[54] Manor and Simons decided they would use USAF helicopters and Army Green Berets to conduct the rescue. A decision was made privately to assemble an all-volunteer force that, for security reasons would only be told they were volunteering to conduct a secret mission of great importance.[55]

Gen Manor returned to Eglin Air Force Base, Headquarters of the USAF Special Operations Forces, and assembled the air element. The primary air element would consist of Five HH-53s, one HH-3, two MC-130 Combat Talons and five A-1Es. Crewmember selection would be based on experience, proven performance and volunteer status.[56] The resulting force was highly experienced; capable and combat hardened, with recent tours in Vietnam.

Concurrently, Col Simons returned to Ft Bragg, Headquarters US Army Special Forces Command, and assembled the ground element. Out of the more than 500 Green Beret volunteers, Col Simons selected 100 that possessed all the identified skills required for the mission.[57] "Although, a force of 100 men was considered excessive it was required to provide for redundancy and a reservoir of spares that were deemed necessary."[58]

From the start, the commanders of the rescue team organized its training program to be as secret and as realistic as possible. The rescue team assembled at Eglin Auxiliary

[52] Lieutenant General LeRoy J. Manor, "The Son Tay Raid November 21, 1970" unpublished manuscript, n.p.; on-line, Internet, 18 February 1998, available from http://www.aircommando1@earthlink.net.
[53] Ibid.
[54] Ibid.
[55] Ibid.
[56] Ibid.
[57] Ibid.
[58] Ibid.

Field Number 3, also known as Duke Field, and began training. The Central Intelligence Agency (CIA) provided a model of the Son Tay prison, which guided construction of a full-scale replica near Duke Field.[59] The training was conducted in phases that increased in complexity and realism as they progressed. "Training culminated with two, five-and-one-half hour full-profile missions flown for the benefit of Joint Chiefs of Staff (JCS) observers who pronounced the force ready."[60]

The range characteristics of the helicopters indirectly determined the date of the rescue mission. The HH-53's and HH-3 did not have the unrefueled range required to conduct the rescue mission. Therefore, air refueling was critical to the mission, with the helicopters refueling both on ingress and egress.[61] The air-refueling requirement necessitated weather conditions consisting of cloudless skies and a quarter moon, 35 degrees above the horizon.[62] The moon illumination requirement restricted the raid's window of opportunity to the 21st through the 25th of October and to the 21st through the 25th of November.[63] The team was not prepared to conduct the raid prior to the October window and the rainy season followed the November window, which would reduce the possibility of favorable sky conditions.

Since President Nixon did not approve the raid in time to execute during the October window of opportunity, General Manor established the initial execution date as the night of the 21st of November. However, with a typhoon bearing down on Vietnam and an unfavorable weather forecast for the 21st through the 25th, he moved execution up by 24 hours.

Execution

By 2325 hours, 20 November (local Thailand time) five HH-53's and one HH-3 helicopter carrying 56 Green Berets, distributed among two HH-53's and the HH-3, had departed Udorn AB, Thailand enroute to an air refueling track over northern Laos.[64] Two

[59] Ibid.
[60] Col (Ret) Benjamin Kraljec, mission planner, in Lieutenant General LeRoy J. Manor, "The Son Tay Raid November 21, 1970" unpublished manuscript.
[61] Interview with Lieutenant General LeRoy J. Manor, 21 February 1998.
[62] Lieutenant General LeRoy J. Manor, "The Son Tay Raid November 21, 1970" unpublished manuscript.
[63] Ibid.
[64] Lieutenant General LeRoy J. Manor, "The Son Tay Raid November 21, 1970" unpublished manuscript.

HC-130P tanker aircraft led the helicopter formation. After refueling from the HC-130's over northern Laos, the helicopters joined formation with the just-arrived and blacked out MC-130 "Combat Talon" which had all the sophisticated electronic gear to navigate the helicopter formation undetected by enemy radar to Son Tay.[65]

Five A-1 Skyraiders, that would provide Close Air Support (CAS), had departed Nakhom Phanom AB, Thailand and joined up with a second MC-130. This assault force proceeded low level toward Vietnam and the Son Tay POW camp. The precision low-level navigation supplied by the MC-130's was critical because "seconds not minutes mattered if they were going to be able to arrive unannounced and quickly eliminate the opposition."[66]

As the rescue force continued toward Vietnam, ten F-4's departed Ubon AB, Thailand to provide protection from North Vietnamese MIG's. Additionally, five F-105 "Wild Weasels" departed Korat AB, Thailand to provide protection from Surface to Air Missile (SAM) sites. In addition to these forces the US Navy launched a massive 69-sortie diversionary raid on Hanoi, using flares only, to occupy the North Vietnamese radar operator's attention.

The MC-130 led the helicopters to the initial point at 500ft above ground level (AGL). At the initial point, the plane's crew, announced the final heading to the camp, climbed to 1500ft AGL with two HH-53s and proceeded straight for Son Tay to drop flares over the camp. Meanwhile, a third HH-53 led an HH-3 to the camp and destroyed the two guard towers with its mini-guns. As the pilot of the H-3 cleared the remains of the two guard towers he intentionally crash-landed his aircraft in the compound in accordance with the plan. The small dimensions of the compound, to small too fit the larger H-53, necessitated crash landing the smaller H-3 into the compound in order to get a Green Beret element on the ground as quickly as possible. In order for the plan to succeed, the Green Berets needed to get to the POW's before the guards could be alerted.

"Simultaneous with the landing of the assault force, two additional HH-53s were to land opposite the south side of the camp, allowing its troops to immediately fan out and conduct a search of all the buildings for Americans while prevent reinforcements

[65] Col (Ret) Jay Strayer, Co-pilot, HH-53, Apple 2, in Lieutenant General LeRoy J. Manor, "The Son Tay Raid November 21, 1970" unpublished manuscript.

from interfering."[67] One of these H-53s landed at the designated landing zone at the Son Tay camp but the other one, with Bull Simons and 21 raiders onboard, landed at a similar looking building 200 meters south.[68] Bull Simon and his raiders were on the ground for only five minutes before re-boarding the helicopter and moving to the correct site. However, in that five minutes they killed approximately 200 enemy troops.[69]

"The raiders, having the benefit of initiative, a rehearsed plan of action and not suffering from the element of shock that was imposed on the defenders quickly disposed of the camp contingent."[70] However, there were no POW's found in the camp. The raiders were on the ground for 29 minutes, had annihilated all the North Vietnamese forces and had suffered no casualties.[71] The mission had been executed exactly as planned but no POW's were rescued.

Outcome

> *"Don't let anyone tell you that this mission was a failure. We will learn, as the results develop, that many benefits will accrue as a result of having done this."*
>
> Admiral John McCain
> CINCPAC

The mission was a failure in that it did not accomplish the primary objective of rescuing American POW's. However, the mission was a success in that it proved to the world that the US could and would attempt to rescue its POW's. They were not forgotten. President Richard M. Nixon expressed his belief that the rescue attempt would result in the improvement of morale among the POW's, the next of kin and, in fact, the whole country.[72]

The raid in fact had many favorable outcomes for POW's in North Vietnam. The North Vietnamese fearing another attempt at a rescue consolidated all POW's in the two main prisons in Hanoi. This consolidation forced the North Vietnamese to abandon the

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[66] Interview with Lieutenant General LeRoy J. Manor, 21 February 1998.
[67] Lieutenant General LeRoy J. Manor, "The Son Tay Raid November 21, 1970" unpublished manuscript.
[68] Ibid.
[69] Ibid.
[70] Ibid.
[71] Ibid.
[72] Lieutenant General LeRoy J. Manor, "The Son Tay Raid November 21, 1970" unpublished manuscript.

practice of keeping a large number of POW's in solitary confinement. Morale immediately improved and, as a result, general health improved resulting in lives saved.[73] As former Son Tay POW, Col (Ret) Julius "Jay" Jayroe recalls:

> *Short of being there, one cannot imagine the positive effect it had on those of us who were destined to spend some two and a half years more as POW's. One should recall that it had been two years since the US had stopped bombing North Vietnam, and our faith was being severely tried. But the Son Tay rescue attempt dispelled all doubt: WE WERE NOT FORGOTTEN; OUR COUNTRY CARED!! During the hard times ahead, our renewed faith in God and Country served us well.*

Implications

The Son Tay POW rescue attempt has strategic implications that highlighted the utility of CSAR forces. While no POW's were rescued, the attempt increased the morale of the POW's, troops and families back home. Additionally, the mission demonstrated to the world that the United States of America was concerned about its POWs and had the capability and will to go after them. As a result the POW's were consolidated in Hanoi and their living conditions improved.

In the raid on Son Tay, range and survivability were enablers that allowed the mission to be launched and had an indirect effect on the success or failure of the mission. However, speed was essential to the success of the mission and had a direct effect on the probability of success.

Range considerations affected how the mission was planned and thereby had an indirect effect on the overall success or failure of the mission. The range of the helicopters did not prevent this mission from being a success. However, the helicopters limited unrefueled range, in comparison with fixed-wing aircraft, increased the number of support aircraft required by necessitating air refueling. The air refueling dictated weather requirement that restricted the window of opportunity to conduct the mission to a few days a month. The helicopters limited range indirectly increased the chance of mission abort/failure by increasing the number of variables that could affect the mission.

If the helicopter force could not get to the Son Tay POW camp and back without being destroyed there was no point in launching the mission. To enhance the

[73] Ibid.

survivability of the helicopters a fighter umbrella was established over the helicopter force. General Manor was not concerned about the survivability of the helicopters in the final plan.[74] He believed the helicopters were capable of withstanding the enemy threat given the MIG, SAM and CAS protection provided by fighter aircraft.[75] However, the need to establish the fighter umbrella over the helicopter force indirectly increased the chance of mission abort/failure by increasing the number of variables that could impact on the mission.

Speed was crucial to mission success and a fundamental concern in planning the mission. The ability to arrive undetected was a major concern for the rescue force. In order to secure the safety of the POW's surprise was important to alleviate the possibility of the guards using the POW's as shields or harming them. The North Vietnamese radar was capable of detecting the rescue force twelve minutes before the first aircraft arrived over the compound.[76] The Navy's diversionary attack on Hanoi was designed to draw the radar operator's attention away from the Son Tay area long enough for the rescue force to get in before a warning could be passed.[77] If surprise was not achieved the chance of success was low. Surprise was dependent on the ability of the rescue force to arrive undetected and speed was the critical factor in arriving undetected. Therefore, speed had a direct effect on the success or failure of the Son Tay mission.

Examination of the Son Tay raid indicates that speed, range and survivability were factors that effected the success or failure of the mission. Range and survivability factors had an indirect effect, while speed had a direct effect on the successful execution of the Son Tay raid. A generalization cannot be made as to the importance of speed, range and survivability on the success or failure of rescue missions through the analysis of a single mission. Therefore, the next chapter will analysis the *Mayaguez* incident and the impact speed, range and survivability had on the outcome of that mission.

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[74] Ibid.
[75] Ibid.
[76] Interview with Lieutenant General LeRoy J. Manor, 21 February 1998.
[77] Ibid.

Chapter 3

Mayaguez Incident

The *Mayaguez* incident is an example of the use of rescue forces to conduct a hastily planned and makeshift rescue operation. In the *Mayaguez* operation range, speed and survivability factors all had a direct effect on how the assault on Koh Tang Island was conducted. However, as in the raid on Son Tay, speed was the most essential factor in determining success or failure. The *Mayaguez* case study continues to suggest that speed might be the dominant variable in CSAR operations.

Background

On 12 May 1975 the Delta Exploration Company in Jakarta, Indonesia received a distress message from the U.S. containership *S.S. Mayaguez*, it had been fired upon and boarded by Cambodians.[78] The Cambodians were Khmer Communists that had seized the *Mayaguez* in international waters approximately eight nautical miles northwest from Poulo Wai Island, Gulf of Thailand.[79] The *S.S. Mayaguez* was subsequently moved to and anchored one mile off the northeast coast of Koh Tang Island.[80]

U.S. Navy P-3 Orion aircraft located, identified and followed the movement of the *Mayaguez* to Koh Tang Island but uncertainty existed about the location of the crew. On-scene aircraft were ordered to stop movement of the *Mayaguez* to mainland ports and authorized to use force if required[81]. Reports from surveillance aircraft indicated that the

[78] Urey W. Patrick, *The Mayaguez Operation*, CNS Report 1085 (Arlington, VA: Center For Naval Analyses, 1977), 5.
[79] PACAF/IN, Background Paper, 16 May 75.
[80] Patrick, p. 5.
[81] Comptroller General, "The Seizure of the *Mayaguez*-A case Study of Crisis Management," a report to the Subcommittee on International Political and Military Affairs, House Committee on International Relations, 94th Cong., 2nd sess. (Washington, D.C.: Government Printing Office, 1976), 118.

crew had been moved to Koh Tang Island and that some of the crew might have been moved to Kompong Som, Cambodia in a forty foot fishing boat.[82] An USAF fighter making a strafing run on the forty-foot fishing boat recognized Caucasian faces on board and aborted his attack.[83] Actually, all of the crew was moved to Kompong Som, but U.S. authorities in Washington were not aware of this fact.[84] When diplomatic efforts to recover the ship and her crew failed, President Ford directed their recovery by decisive military action.[85] Therefore, the decision was made to assault Koh Tang Island.

Preparation

There were several Courses of Action (COA) considered privately, three of which entailed an assault on Koh Tang Island.[86] The first of which was an insertion of USAF security policemen via USAF helicopters onto the *Mayaguez* and Koh Tang Island in an effort to recover both the ship and her crew.[87] Air Force HH-53 (CSAR) and CH-53 (SOF) helicopters, along with Air Force security police were assembled at U Tapao Royal Thai Air Force Base, Thailand.[88] This force, assembled at U Tapao from other bases in Thailand, represented the immediate force capable of initiating a rescue operation.

The second COA that entailed an assault on Koh Tang Island was to use the USAF helicopters at U Tapao to insert a larger and more capable USMC combat contingent in conjunction with USN surface vessels onto the *Mayaguez* and Koh Tang Island. Therefore, Marine Battalion Landing Team (BLT) 2nd Battalion, 9th Marines (1000 men) was airlifted from Okinawa, Japan to U Tapao Thailand and Marine Rifle

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[82] Patrick, p 5.
[83] David R. Mets, *Land-Based Air Power in Third World Crises* (Maxwell Air Force Base, Alabama: Air University Press, 1986) 42.
[84] Patrick, p 5.
[85] DCS/Plans and Operations, *Assault on Koh Tang*, (Hickam AFB: Headquarters Pacific Air Force, 1975), 1.
[86] For a more detailed synopsis of the various COA considered see David R. Mets, *Land-Based Air Power in Third World Crises, p. 45.*
[87] Patrick, p. 33.
[88] The HH-53s were assigned to the 40th ARRS, used the call sign Jolly Green, were air refuelable, had 450 gallon foam-filled tip tanks (non-explosive auxiliary fuel tanks) and three gun positions (right, left and tail) that were fitted with the 7.62mm minigun. The CH-53s were assigned to the 21st Special Operations Squadron (SOS), used the call sign Knife, were not air refuelable, had 650 gallon non-foam-filled tip tanks and two minigun positions (right and left but no tail) *Assault on Koh Tang, p. 2.*

Company D, BLT 1st Battalion, 4th Marines (120 men) was airlifted from Subic Bay to U Tapao.[89] Additionally the *USS Coral Sea* (CVA-43) and escorts, the *USS Holt* (DE-1074) and the *USS Henry B. Wilson* (DDG-7) were ordered to the vicinity of Koh Tang island to assist in rescue operations.[90]

A CH-53 crashed enroute to U Tapao resulting in the death of its four crewmembers and the nineteen security policemen onboard.[91] This loss of nineteen security policemen eliminated the first COA, as the force was now considered too small to assault both the island and the ship.[92]

The third COA, which entailed an amphibious assault on Koh Tang Island, was also eliminated due to a sense of urgency. The earliest an amphibious assault force could arrive in the area was approximately 2300, (all time references are local Gulf of Thailand time) 16 May.[93] Therefore, the second COA was selected and approved as the plan for securing the rescue of the *Mayaguez* and her crew.

The final plan called for USAF helicopters to insert an USMC boarding party on the *USS Holt*, which would then pull alongside the *S.S. Mayaguez* for the assault. Additionally, eight USAF helicopters in four pairs would insert 170 Marines into two landing zones (LZ), one on the eastern side and one on the western side of the northern tip of Koh Tang island to search for the crew. The eastern LZ was referred to as east beach and the western LZ was referred to as west beach. Upon completion of offloading the first load of Marines the helicopters would return to U Tapao for a second load. All told, the planners envisioned inserting approximately 450-600 Marines on Koh Tang Island.[94]

In conjunction with the assault on the *Mayaguez* and Koh Tang Island, USN fighter-bombers from the *USS Coral Sea* and USAF B-52 bombers were to strike mainland targets at Kompong Son.[95] USAF Tac Air, Airborne Command and Control

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[89] Patrick, p. 6.
[90] Ibid.
[91] Ibid., p. 31.
[92] Col Gary L. Weikel, Air Force Special Operations Command, interviewed by author, 20 February 1998. Col Weikel as a First Lieutenant was the co-pilot on Jolly Green 11, a HH-53 that participated in the *Mayaguez* rescue operation.
[93] Patrick, p. 30.
[94] Summarized and paraphrased from *Assault on Koh Tang, p. 2-7.*
[95] Patrick, p. 33.

Center (ABCCC), AC-130 Spectre gunship and refueling aircraft were available along with USN surface ships, capable of providing naval gunfire, to assist the assault force on Koh Tang island.

Execution

Three USAF HH-53s, Jolly Green (JG) 11,12 and 13, delivered 54 Marines, 6 civilian military sealift volunteers, 2 USAF EOD, 2 USN and 1 Army linguist to the *USS Holt* at 0605 on the 15th of May.[96] Subsequently, at 0725 the *USS Holt* would pull alongside the *Mayaguez* and transfer the boarding party to her following a CBU-30 riot control agent drop by a pair of USAF A-7Ds.[97] The *Mayaguez* had been abandoned and therefore, quickly secured without incident. The *USS Holt* took the *Mayaguez* under tow at 0833 and moved it back into international waters.

The Khmer communist forces had released the crew of the *Mayaguez* at 0607 and they were being transported back to the *Mayaguez* via a small Thai boat when the *USS Henry B. Wilson* intercepted them at 1005.[98] The *USS Henry B. Wilson* transferred the crew back to the *S.S. Mayaguez* at 1330 and departed for Koh Tang Island. The *USS Holt* escorted the *Mayaguez*, now under her own power, until 1700 when the *Holt* was directed to join the *USS Henry B. Wilson* at Koh Tang Island.[99]

At the same time that the boarding party was being delivered to the *USS Holt*, the first wave of Marines was being delivered to the beaches of Koh Tang Island. No LZ preparation by air strikes or naval gunfire occurred out of concern for the safety of the *Mayaguez* crew and because the threat was thought to be light.[100] The helicopters approached east and west beach at approximately 0555 in four pairs separated by several minutes carrying a total of 170 Marines.[101]

Knife (K) 21 and K 22 proceeded to the western beach, where K 21 at 0555 was engaged with small arms fire, rockets and mortars while unloading its Marines. K 21 lost an engine and suffered transmission damage that caused it to ditch about a mile off of the

[96] *Assault on Koh Tang, p. 2.*
[97] Patrick, p. 55.
[98] Ibid.
[99] Ibid.
[100] *Assault on Koh Tang, p. 4.*
[101] Ibid.

beach, after it had offloaded its Marines.[102] K 22 while attempting to reach the western beach at 0600 came under heavy fire and was severely damaged. It was rapidly losing fuel and had to abort toward the Thai coast with its Marines still on board.[103]

K 23 and K 31 headed for the eastern beaches at 0600 where K 23 suffered severe damage to it rotor system, from heavy enemy fire, and K 31 burst into flames.[104] K 23 lost an engine and the tail section separated from the aircraft causing it to crash on the beach. The crew and Marines of K 23 survived the crash and established a position in the tree line. K 31, which was hit by mortar rounds, rifle grenades and rockets, burst into flames and crashed on the beach resulting in 13 dead.[105] Ten Marines and three crewmen survived the crash and swam to sea where the *USS Henry B. Wilson* picked them up at 0715.[106]

K 32 inserted its Marines into the western beach at 0640 after USAF TacAir had made strafing runs on the island. However, it suffered severe damage and after limping back to U Tapao was out of action for the remainder of the day.[107] JG 41, the second ship in the K 32 formation, on its fifth attempt at 1010 was able to offload 22 of its 27 Marines before being driven off the west beach by accurate mortar fire.[108] However, JG 41 suffered heavy battle damage and upon return to U Tapao was out of commission for the remainder of the mission.[109]

JG 42 at 0720 was able to insert its Marines into the western beach but sustained heavy damage that removed it from service upon its return to U Tapao. JG 43 was unable to insert its Marines into the western beach and inserted them approximately 1,000 meters south of the LZ at 0720.[110]

While the insertions on the west beach were going on JG 13 at 0815 attempted to rescue the survivors of the K 23 crash on the east beach. With the support of A-7s, JG 13 was able to make it to the beach through heavy fire. However, the Marines and crewmen

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[102] Ibid. p. 7.
[103] Ibid. p. 9.
[104] Ibid.
[105] Ibid., p. 11.
[106] Patrick, p. 71.
[107] *Assault on Koh Tang, p. 14.*
[108] Ibid., p. 20.
[109] Ibid., p. 21.
[110] Ibid., p. 16.

of K 23 were pinned down and unable to get to the aircraft.[111] The aircraft suffered heavy damage and was forced to recover at Rayong, Thailand where it was out of action for the remainder of the mission.[112]

The first wave of insertions was over with 57 Marines inserted on the *USS Holt* and 131 Marines inserted on Koh Tang Island. Fifteen U.S. personnel had been killed in action.[113] Three of the nine helicopters participating in the insertion of Marines on Koh Tang Island had been shot down. Five additional helicopters had suffered major battle damage precluding them from further action. This left only five helicopters to conduct the second wave insertions.

K 51, JG 43, JG 11 and JG 12 all successfully inserted the second wave of Marines onto the western beach between 1155 and 1200, bringing the total number of Marines on Koh Tang island to 222.[114] However, K 52, which had attempted to insert its Marines to the eastern beach at 1150, was unsuccessful and had sustained heavy damage. K 52 was leaking fuel and was forced to abort toward the Thai coast, where it was out of action for the remainder of the day.[115]

With increased close air support and naval gunfire now available JG 11 at 1815 was able to rescue the 20 Marines and five crewmembers from the east beach. Although, suffering battle damage JG 11 was able to recover to the *USS Coral Sea* that had arrived in the area at 0745.[116] Once JG 11 was clear of the beach JG 12 hovered over the wreck of K 23, where a Marine from the K 31 crash was believed to be held up.[117] After hovering there for two minutes, with no sign of the Marine, the rescue attempt was aborted. However, JG 12 had suffered heavy battle damage and was forced to land on the *USS Coral Sea*, where it was out of action for the remainder of the mission.[118]

With the successful rescue of the men on the east beach, the decision was made to evacuate all Marines from Koh Tang Island. Between 1850 and 1857, as darkness fell K 51, JG 43 and JG 44 were able to evacuate the first load of Marines from west beach. K-

[111] Ibid., p. 17.
[112] Ibid., p. 18.
[113] Ibid., p. 21.
[114] Ibid., p. 24-26.
[115] Ibid., p. 24.
[116] Ibid., p. 29-30.
[117] Ibid., p. 30.
[118] Ibid.

51 and JG 43 proceeded to the *Coral Sea* to offload their Marines, refuel and launch for a second load.[119] JG 44 in order to facilitate the rapid extraction of Marines that were becoming increasingly vulnerable to ground attacks, decided to offload its first load of Marines on the *Holt*, which was closer than the *Coral Sea*.[120] JG 44 was able to return to Koh Tang Island and pick-up a second load of Marines at 1930 and bring them to the *Coral Sea*. K 51 evacuated the final load of Marines to the *Coral Sea* at 2010.

As the events on Koh Tang Island were unfolding, attack aircraft from the *Coral Sea* were attacking targets on the Cambodian mainland in the vicinity of Ream airport and the harbor at Kompong Som. There were four launches of tactical aircraft from the *Coral Sea* with intended targets on the mainland of Cambodia.[121] The President preferred the Navy tactical aircraft attacks over the B-52 attacks, as he believed them "more surgical and less destabilizing."[122]

The Navy's first fighter-bomber launch intended to attack targets in the Kompong Som vicinity at 0745 was denied permission to attack by the President minutes before the scheduled attack time.[123] However, the second and third launches were given permission to attack and hit targets at Ream airfield and Kompong Som area at approximately 0910 and 1100 respectively.[124] The targets for the fourth launch were changed from Kompong Som to provide close air support on Koh Tang Island since at 1155 the Joint Chiefs of Staff had directed that all offensive operations related to the seizure of the *Mayaguez* cease.[125]

Outcome

The *Mayaguez* and her crew were returned and all U.S. personnel were evacuated from Koh Tang Island. Total U.S. casualties were 15 killed in action, 3 missing in action and approximately 49 wounded.[126] These numbers do not include the fatalities from the CH-53 crash that killed the crew and USAF security policemen onboard. Three

[119] Ibid., p. 32.
[120] Ibid., p. 33.
[121] Patrick, p. 95.
[122] Mets, P. 45.
[123] Patrick, p. 95.
[124] Ibid.
[125] Ibid.

helicopters were destroyed and all but one of the helicopters participating in the operation had sustained damage.

The assault on Koh Tang (0600), the boarding of the *Mayaguez* (0725) and the bombing of the Kompong Som (0910 and 1100) could have had no effect on the decision to release the crew of the *Mayaguez*. The decision to release the crew was announced at 0607 and therefore, the actual decision must have been made some time prior. The decision to release the crew of the *Mayaguez* had been made before the actions on Koh Tang could have affected the decision-maker's judgment.

The miscalculation of the size of the Khmer Communist force on Koh Tang Island led to the commitment of too limited a force to accomplish a mission which, given the decision to release the crew had already been made, need not be undertaken in the first place.[127] "The initial deployment resulted in a situation demanding the deployment of additional forces to avoid disaster, and then the employment of more force and firepower to disengage."[128] The mission to rescue the *Mayaguez* was successful but not because of any actions on Koh Tang Island.

Implications

In the *Mayaguez* operation range, speed and survivability factors all had a direct effect on how the assault on Koh Tang Island was conducted. However, speed was the most essential factor in determining to what degree the actions on Koh Tang Island would be a success or a failure.

The effect of the limited range of helicopters in comparison to fixed-wing aircraft reduced the available options and increased the variables involved, thus increasing the chance of mission failure. The helicopters had the range to fly from U Tapao, Thailand to Koh Tang Island and return. The straight-line one way distance was 190 nautical miles (NM).[129] However, at this range the CH-53s could stay in the area only a short time before they had to return to U Tapao for fuel. This limited their ability to wait for a more

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[126] *Assault on Koh Tang, p*. 37.
[127] Earl H. Tilford, Jr., *SETUP, What the Air Force Did in Vietnam and Why* (Maxwell Air Force Base, Ala.: Air University Press, 1991), 282.
[128] Ibid.
[129] Patrick, P. 7.

favorable tactical situation on the island and to be available to assist the ground troops in an emergency.

The HH-53s ability to air refuel was critical to the success of the mission once things went wrong.[130] The HH-53 had the ability to loiter in the area while waiting for supporting fires from USAF and USN assets. The ability to air refuel extended the range of the HH-53 and therefore loiter time, adding flexibility to the operation on Koh Tang Island. However, depending on air refueling to increase range expands the number of supporting aircraft required and establishes a need for favorable weather conditions. Nevertheless, range proved to be an important factor in determining how this mission was conducted and in the probability of success.

The majority of the damage sustained by the helicopters was either while sitting on the beach or hovering in the vicinity of the beach. Most aircraft ensure their survivability through a mix of speed, maneuverability, and armament. An immobile aircraft, no mater how robust its armament, will be unable to withstand continuous, accurate, concentrated fire. However, it is clear from the *Mayaguez* incident that survivability effected how the mission was conducted and its chance of success.

Survivability concerns affected where and when the Marines were offloaded on the beach and the degree of involvement of supporting fixed-wing aircraft. Additionally, the ability to land the second wave of Marines to stabilize the situation and later to withdraw the Marines was in doubt as aircraft were taken out of action through either being shot down or damaged. Aircraft survivability was an important factor in determining the outcome of the actions on Koh Tang Island.

Speed was the most important factor in determining if the actions on Koh Tang Island would end in success or failure. USMC amphibious doctrine emphasizes a rapid buildup of overwhelming combat power. Therefore, the speed with which the helicopters could land Marines on the beach was a critical factor in reducing the time required to build up combat power.

The speed of the helicopters resulted in an estimated four hour cycle time between the first and second wave assault.[131] This cycle time increased as the planned ten minute

[130] Col Gary L. Weikel, Air Force Special Operations Command, interviewed by author, 20 February 1998.
[131] Patrick, p. 40.

insertion of the first wave increased to three hours.[132] The slow buildup of combat power on the island affected the Marines efforts to secure the beachhead. Moreover, if not for the arrival of the *USS Coral Sea* in the vicinity of Koh Tang Island around midday and the firepower delivered by fixed-wing aircraft, the cycle time of four hours would have made the evacuation impossible when the decision was made to evacuate the Marines. Speed was essential in both building up combat power on the Island and in evacuating the troops from the island.

Examination of the *Mayaguez* incident indicates the effect of speed, range and survivability factors on this rescue missions impacted how the mission was conducted and the likelihood of success. These factors limited the options available, increased the variables involved and increased the risk of failure. The next chapter evaluates the effects of speed, range and survivability on the Iranian hostage rescue attempt.

[132] Ibid., p. 57.

Chapter 4

Iranian Hostage Rescue Attempt

The Iranian hostage rescue attempt illustrates the use of rescue forces in a deliberately planned and rehearsed mission that ended in disaster. The effects of speed, range and survivability were important factors that contributed to the complexity and ultimate failure of this mission. The planning and execution of the rescue attempt reveal the premium importance of range and speed in rescue operations.

Background

> *TEHERAN, IRAN, Nov 4 – Moslem students stormed the United States Embassy in Teheran today, seized about 90 Americans and vowed to stay there until the deposed Shah was sent back from New York to face trial in Iran.*[133]

The 4 November 1979 seizure of the U.S. embassy in Teheran began the 444-day ordeal known as the Iranian hostage crisis. Throughout this ordeal President Carter was briefed on a myriad of proposals for freeing the hostages, ranging from diplomatic initiatives to the use of nuclear weapons. Military actions discussed from the first day of the crisis in the National Security Council (NSC) included: seizure of oil fields, retaliatory bombing, mining of Iranian harbors, blockade, seizure of Kharg Island, covert operations and a rescue operation.[134]

Dr. Zbigniew Brzezinski, President Carter's national security advisor, requested that contingency plans be prepared for a rescue operation, for use if the militants started

[133] Reuters, "Teheran Students Seize U.S. Embassy. "*The New York Times*, 5 November 1979.
[134] Zbigniew Brzezinski, *Power and Principles: Memoirs of the National Security Advisor 1977-1981*. New York: Farrar, Straus, and Giroux, Inc., p. 477-500.

executing hostages.[135] The obstacles to overcome were enormous. There were no U.S. bases in the vicinity, no intelligence network in place and no force in existence that had the capability of executing the rescue.

General David Jones, Chairman, Joint Chiefs of Staff (CJCS), established a new Joint Task Force (JTF) with the mission of organizing, planning and training for the rescue mission. Major General James B. Vaught was selected to command the new JTF. For a rescue mission to be successful, surprise would be required. Therefore, Operations Security (OPSEC) became the first and most important element in organizing and training a rescue force.[136]

Preparation

Col "Charlie" Beckwith, commander of the Army's elite counterterrorist unit known as "Delta Force", developed the initial rescue plan and described it as "straightforward...and suicidal".[137] The plan entailed a parachute drop east of Teheran followed by a movement through the city via stolen trucks to assault the American embassy.[138] Once they had fought their way into the embassy, located and freed the hostages, they would move the whole force through the city to Mehrabad Airport.[139] Delta would then seize the airport and hold it until U.S. aircraft could land and evacuate the entire contingent or if aircraft could not land then evade overland.[140]

Both Beckwith and General Vaught believed that this initial plan had zero chance of success and that additional time was necessary to develop a reasonable plan. Pressure for an immediate rescue attempt was reduced when the Iranian militants released thirteen hostages, heightening the hopes for a diplomatic solution. The JTF used this time to organize and train a force capable of accomplishing the mission.

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[135] Ibid., p. 478.
[136] U. S. Department of Defense, *Rescue Mission Report*, Washington D.C.: 1980, p. 6.
[137] Colonel Charlie A. Beckwith and Donald Knox, *Delta Force*, New York: Harcourt, Brace, and Jovanovich, 1983, p. 186
[138] Ibid.
[139] Ibid.
[140] Ibid.

The final plan to rescue the hostages, Operation EAGLE CLAW, by necessity was complex and demanding.[141] Six USAF C-130s (three MC-130 Combat Talons and three EC-130s, configured for ground refueling) would takeoff from Masirah Island (Oman) with the assault force onboard and fly to Desert One, a refueling site established on a sand strip 200 miles southeast of Teheran in Iran's Dashet-e-Kavir desert. Here they would transfer the assault force and refuel eight Navy RH-53D Sea Stallion helicopters (flown by USMC pilots) that had launched from the *USS Nimitz* some 600 miles away in the Gulf of Oman. The C-130s would then return to Masirah and the helicopters would proceed to Desert Two where they would offload the assault force and move to hide sites in the hills around Garmsar. At Desert Two the assault force would be met by DOD agents, already in Iran, and moved to a hide site for the day. At nightfall the Delta assault force would move via trucks, provided by the CIA, to the embassy and free the hostages. Concurrently, a thirteen man Special Forces (Green Beret) team would move via vehicles to the Foreign Ministry Building and free the three hostages that were being held at that location. The helicopters that had launched from their hide sites and were orbiting north of the city would land at the embassy (or the nearby Amjadieh soccer stadium if the embassy was blocked) and the Foreign Ministry Building and evacuate the hostages and rescuers. Two AC-130 gunships would orbit over the city and provide fire support as required. The helicopters would then fly to Manzariyeh airfield, thirty-five miles south of Teheran, that would have been seized by U.S. Army Rangers. Once there the helicopters would be destroyed and everyone would load on USAF C-141 Starlifters and fly out of the country.[142]

Planning, training and execution were totally compartmentalized to avoid leaks. "Training was planned and conducted on a highly decentralized basis within an informal component command structure that does not appear to have been clearly established."[143] Training was conducted by the different elements at different sites throughout the United States. A thorough, integrated training exercise of the entire JTF was never conducted.[144]

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[141] Ibid., p. 194
[142] Summarized and paraphrased from Colonel Charlie A. Beckwith and Donald Knox, *Delta Force*, p. 253-256.
[143] *Rescue Mission Report*, p. 23.
[144] Ibid.

The selection and training of helicopter pilots caused a significant problem throughout the training. The Navy's RH-53D was selected for its range, payload and shipboard compatibility characteristics.[145] Therefore, Navy pilots were selected because of their familiarity with the aircraft and augmented with USMC pilots who were more familiar with the type of flying required. Only four crewmembers from the original Navy group were still involved following a December 4th rehearsal of the Desert One operation at Yuma Arizona. There the performance of the helicopter crews was so bad that some of the Delta commandos refused to fly with them.[146] A worldwide search was undertaken to assemble the best "stick and rudder" men in the USMC to replace the crews, which had progressed so slowly in their training.[147]

Col Beckwith believed that the helicopter pilot's task was among the most difficult of the mission.

> *These leathernecks were being asked to do the something extraordinary. Before this time, flying a helicopter at night was unusual. When it was done, it was always in ideal conditions. Now these pilots were being asked to fly right off the deck through rough canyon country, not at 1,500 feet, but down in the canyons where radar couldn't detect them, and do it without lights![148]*

Execution

> *Far better it is to dare mighty things, to win glorious triumphs, even though checkered by failure, than to take rank with those poor spirits who neither enjoy much nor suffer much, because they live in the gray twilight that knows not victory nor defeat.*
>
> Theodore Roosevelt

The C-130s departed Masirah on time, with the assault force onboard, and headed toward Desert One. They arrived at Desert One on time and landed with the assistance of remotely activated low intensity runway lights, which had previously been installed by a site reconnaissance team. The C-130s repositioned for helicopter refueling operations, deployed the security force and awaited the arrival of the helicopters.

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[145] Ibid., p. 32.
[146] Colonel James H. Kyle, USAF (Ret.), T*he guts to try: the untold story of the Iran hostage rescue mission by the on-scene desert commander* (1990; reprint, Phoenix, AZ.: Primer Publishers, 1995), 91-106.
[147] Ibid., p. 106.
[148] Beckwith, p. 228.

The C-130 arrival at Desert One did not go without incident. The first aircraft had to execute a missed approach to avoid a vehicle traveling along the road adjacent to the strip.[149] The aircraft was able to land on its third approach and deploy the road watch team. One of the road watch teams was forced to fire shots to stop a bus with 44 people onboard, including the driver.[150] In accordance with the contingency plan, the 44 Iranians would be flown out of the country on the C-130s and returned at the completion of the operation. Additionally, one of the road watch teams encountered a small fuel truck followed by a pickup truck that refused to stop.[151] The fuel truck was fired upon and burst into flames. However, the driver managed to jump out of the fuel truck, get into the pickup truck and escape.[152]

The helicopters 600 NM journey to Desert One was not as auspicious as that of the C-130s. "Eight mission-capable RH-53D helicopters departed *Nimitz* on the evening of 24 April 1980. Of these eight, only five arrived at Desert One capable of proceeding."[153]

Helicopter #6 experienced a Blade Inspection Method (BIM) indication approximately two hours into flight.[154] A BIM warning indicates possible loss of nitrogen pressure in the main rotor blade spar. If nitrogen loss is confirmed and was caused by a crack in the spar then ultimately, rotor blade failure could occur. If the rotor blade fails in-flight then the aircraft will be unable to maintain controlled flight and will crash.

The crew of helicopter #6 executed a precautionary landing in the desert to visually check the BIM, in order to confirm the cockpit indication. The BIM indicator on the rotor blade was "popped", indicating possible nitrogen loss. The crew followed normal operating procedures and abandoned the helicopter.[155] Helicopter # 8 landed, picked up the crew of #6 and continued the mission leaving the abandoned helicopter intact in the desert.

"Approximately one hour thereafter, the helicopter formation unexpectedly encountered a dust cloud of unknown size and density. The helicopters broke out of the

[149] *Rescue Mission Report*, p. 50.
[150] Ibid.
[151] Ibid.
[152] Ibid.
[153] Ibid., p. 44.
[154] Ibid.

first area of suspended dust but, within an hour, entered a second, larger and denser area."[156]

While inside this second area of suspended dust, helicopter #5 experienced a failure of several navigation and flight instruments. The pilot, in the severely degraded and deteriorating visibility of the suspended dust cloud, determined that continuing was unwise.[157] He aborted the mission, reversed course and recovered on the *Nimitz*.

Helicopter #2 had experienced a partial hydraulic failure enroute to Desert One but decided to continue with the hope of getting the problem fixed at the refueling site. However, neither the spare part required nor the time needed to fix the problem was available at Desert One. The helicopter was deemed unsafe to continue the mission.[158]

It was determined prior to mission launch that a minimum of six operational helicopters was required to continue the mission past Desert One.[159] With only five operational helicopters Col Kyle, the C-130 and Desert One commander, in conjunction with Col Beckwith, the assault force commander, advised Major General Vaught of their intent to abort the mission. "General Vaught advised the President of this intent and the President concurred in the decision that the mission could not continue, and preparations began for withdrawal of the five operational helicopters, the C-130s, and the rescue force."[160]

It was necessary to reposition the helicopters to allow the first aircraft to arrive at Desert One top off its fuel tanks, in preparation for the flight back to the *Nimitz*. While repositioning, helicopter #4 collided with an EC-130 causing both to erupt into flames, killing eight crewmembers and injuring five other members of the team.[161]

Exploding ammunition and fragments from the burning aircraft impacted and damaged some of the other helicopters. With time and fuel running out Col Kyle decided to abandon all the helicopters and fly everyone out on the remaining C-130s.[162] The bodies of the eight servicemen, the five remaining helicopters, the burning remains of the

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[155] Ibid.
[156] Ibid., p. 9.
[157] Ibid.
[158] Ibid.
[159] Ibid., p. 10.
[160] Ibid.
[161] Ibid.
[162] Ibid.

sixth helicopter and the EC-130 and classified material in three of the helicopters were left behind in the desert.[163] An air strike was requested on Desert One to destroy the equipment left behind but it was disapproved by the President.[164]

Outcome

The morning of 25 April 1980 the world awoke to the news of the failed hostage rescue attempt. American prestige and reputation for military skill and power had been tarnished. Congressional testimony placed the monetary cost for the failed rescue mission at an estimated 193 million dollars.[165] More importantly, eight American servicemen had perished and the hostages were still being held, with no end in sight.

The Iranian hostage crisis issue was an important aspect of the 1980 presidential elections. While it cannot be said that President Carter lost the election based entirely on his handling of the hostage crisis; history does show that the American public was dissatisfied with the handling of the crisis. On 20 January 1981, the day Ronald Reagan was inaugurated as President of the United States, the fifty-three American hostages were released after one year, two months and sixteen days of captivity.

Implications

Operation EAGLE CLAW was a complex plan that accepted a high risk of failure. The effects of speed, range and survivability on the helicopter operations drove the complexity of the air plan, in part. The landing, refueling and transloading of the assault force at Desert One was required because of the helicopter's range. To minimize the risk of being discovered the entire operation from launch until entry into the hide sites was to be accomplished under the cover of darkness. However, the speed of the helicopters required everything to go right in order to arrive at the hide sites before sunrise. Additionally, the whole concept of hiding eight large helicopters in the hills around Garmsar was required because of the relatively slow speed of the helicopters. Due to survivability concerns the helicopter force trained for and flew the entire route at

[163] Ibid., p. 53.
[164] Beckwith, p. 283.
[165] Benjamin F. Schemmer, "22 Months After Desert One, Some on Iran Rescue Try Still Not Decorated",

low level altitudes. This caused them to fly through the dust cloud, become disorganized and eventually for helicopter #5 to abort.

The necessity for a refueling operation at Desert One was driven by the range limitations of the helicopter. With a single fuel load the helicopters were incapable of flying from the *USS Nimitz*, in the Gulf of Oman, with the assault force onboard to Desert Two, moving to the hide sites and transporting the hostages and the rescuers to Manzariyeh airfield the next night. Range was an important factor in determining the probability of success or failure in this mission.

The plan to hide the helicopters in the hills around Garmsar was required due to the speed limitations of the helicopters. The assault force required the element of surprise in order for their plan to work. Therefore, their arrival at Desert Two and the hiding of the helicopters had to be accomplished prior to sunrise to minimize the risk of discovery. The helicopters did not have the speed required to transport the assault force to Desert Two and depart the country before sunrise.

The need to conduct the first night's events during the hours of darkness was an important factor in determining the timing of the mission.[166] A number of seasonal weather conditions, to include the available hours of darkness, would have turned against the mission if it were delayed.[167] Therefore, the speed limitation of the helicopter not only drove the requirement to hide the helicopters inside of Iran but also was a factor in determining the timing of the operation.

The speed and distance limitations of the helicopter drove the requirement for Desert One and the hide sites. Survivability concerns forced the helicopters to fly low level and into the worst part of the dust cloud. The effects of speed, range and survivability were important factors that contributed to the complexity and ultimate failure of this mission.

The effects of speed, range and survivability factors have dictated how rescue operations have been planned and impacted upon the probability of success in the three

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Armed Force Journal International, March 1982, p. 26.

[166] Senate, *The Situation In Iran: Hearing before the Committee on Foreign Relations,* 96th Cong., 2nd sess., 1980, 3.

[167] Ibid.

case studies. The next chapter will look at the operational characteristics, proposed advantages and proposed affordability of the V-22, the only current Tiltrotor aircraft.

Chapter 5

Cost-Benefit Analysis of the V-22

The purpose of this chapter is to outline the proposed benefits and costs of the V-22 for comparison to current and proposed CSAR helicopters. While cost is certainly a factor in determining if the USAF should transition its CSAR forces to the V-22, it is not the only factor. Ultimately, the decision to replace helicopters with tiltrotors must weigh the merits of operational gains against the cost of these gains.

Rationale

In the first chapter, the assumption was made that the range, speed and survivability increases of the V-22 over current and proposed helicopter designs as reported in the Institute for Defense Analyses 1990 report, *Assessment of Alternatives for the V-22 Assault Aircraft Program* are correct. The subsequent chapters looked at three rescue missions and determined that, in varying degrees, helicopter range, speed and survivability impacted upon the success or failure of rescue mission.

As previously mentioned Joint Pub 3-50.2 states, "each Service and the US Special Operations Command are responsible for performing combat search and rescue (CSAR) in support of their own operations." Currently, the primary USAF rescue aircraft is the HH-60G, which is capable of operating only in a low to medium threat environment. The most capable CSAR aircraft in the USAF inventory according to Joint Pub 3-50.2 is the MH-53J, which has the mission of conducting special operations and is under the control of the SOF commander.

Therefore, this chapter will examine the operational characteristics, advantages and predicted life-cycle cost savings of the V-22 versus current helicopters.[168] It will focus mainly on the H-60 and the H-53, the two USAF helicopters that could be charged with conducting CSAR in support of Air Force operations. However, since the USMC is the lead agency for the Department of Defense in the acquisition of the V-22, and the recipient of the bulk of the V-22 fleet, most studies are tailored toward USMC requirements. Nonetheless, the range, speed and survivability criteria that a V-22 fulfilling a USAF CSAR role would require are encompassed in the criteria established for the USMC, USSOCOM and the Navy version's of the V-22. (See chart below)[169]

Table 1. V-22 Design Requirements

Combined Military Services	**U.S. Marine Corps**
VTOL and high-speed cruise	Combat assault, ship and land based
Operations in NBC-contaminated environments	24 troop, 371 km (200 NM) radius of action
Worldwide self-deployment	External cargo capability
Advanced survivability features	**U.S. SOCOM**
Shipboard operations	Special operations
Reduced operations and support cost	18 troop insertion/extraction to 927 km (500 NM) radius of action
Efficient unit maintenance	**U.S. Navy**
Self protection	Combat search and rescue (CSAR) to 890 KM (480 NM) radius of action
	Special warfare team insertion/extraction
	Logistics resupply to ships at sea

Source: *The V-22 Resource Manual*

[168] Since the V-22 is still undergoing its operational testing in the Engineering, Manufacturing and Development (EMD) phase, the majority of the data concerning its capabilities and advantages over current helicopters and predicted life cycle cost savings is supplied by the contractor (Bell-Boeing) or the DOD agencies that are involved in the procurement of the V-22. Therefore, the capabilities, advantages and costs associated with the V-22 are subject to change based on the results of the EMD phase. Additionally, the information in this chapter should be viewed as what the contractor and DOD agencies involved in the procurement of the V-22 currently expect the aircraft is capable of. While these views are supported by numerous government-sponsored studies and independent analyses, the V-22, at the writing of this paper, has not proven its capability to meet all its requirements and not achieved stability in terms of cost or aircraft design.

[169] Congressional Affairs Office, *The V-22 Resource Manual*, (Bell-Boeing, 1997), p. 1-16.

Operational Characteristics

The V-22 Osprey is a vertical and short take-off and land (V/STOL) aircraft that achieves the long-range cruise efficiencies of a twin turboprop aircraft while maintaining the ability to operate like a helicopter.[170] Helicopter rotors must provide all of the lift and attitude control resulting in high rotor system drag, high fuel consumption at higher airspeeds, retreating blade stall and high vibratory loads.[171] The *Osprey's* ability to rotate its proprotors from vertical to horizontal in forward flight, providing thrust while relying on its wing for lift, allows it to achieve very efficient cruise performance and overcome the inherent problems of rotary-wing aircraft. Additionally, the V-22 is very quiet in cruise flight due the large size of the proprotors, which generate the same amount of thrust as conventional turboprops at higher and noisier RPMs.[172]

"The V-22 can operate effectively from a hover to airspeeds of 300 knots and altitudes exceeding 20,000 feet."[173] It has the maneuverability and agility of a helicopter in hover and slow flight and the stability of a twin-engine commuter in airplane mode.[174] "The V-22 can fly continuously at any speed from 83 km/hr (45 knots) rearward and sideward, up to 584 km/hr (315 knots) True Airspeed (TAS) in level flight."[175] The V-22 has an unrefueled, zero payload ferry flight range of over 1,500 NM and is capable of air refueling to extend that range.[176]

"The V-22 combines VTOL and high-speed, night and all weather flight capabilities while incorporating a series of advanced features to improve mission success rates and enhance survivability. These features provide a significant reduction in attrition which, when combined with the V-22's range and payload capability, mean fewer aircraft are required to accomplish a given mission."[177] The following chart details many of the attributes that allow the V-22 to accomplish mission success at lower attrition rates.[178]

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[170] Ibid., p. 1-3.
[171] Ibid., 1-13.
[172] Ibid., 1-14.
[173] Ibid., p. 2-3.
[174] Ibid., p. 1-19.
[175] Ibid.
[176] Ibid.
[177] Ibid., 1-16.

Table 2. V-22 Survivability Attributes

• Higher speed • Long range • Greater altitude capability • Maneuverability	= Better performance	Superior tactical Flexibility
• Night/low-level/ all-weather operations	= Advanced tactics	
• Redundant digital fly by wire flight controls • Composite structure • Inerted fuel tanks • Self-sealing fuel bladders • Hydraulic ram protection • Fire detection/suppression	= Ballistic tolerance	Increased survivability
• Armor • Isolation • Redundancy • Separation	= Crew and systems protection	Reduced vulnerability
• Overpressure • Filtration	= Crew NBC protection	

Source: *The V-22 Resource Manual*

Advantages

The V-22 is more effective, versatile and survivable than current or projected helicopter due to its ability to fly faster, further and higher. As Secretary of Defense William S. Cohen referred to the V-22 as a "leap-ahead" system, which is a brand new system that features the most advanced technology and is designed to ensure that future U.S. forces have the greatest possible battlefield superiority.[179]

A 1997 analysis of the effectiveness of the V-22 versus the H-60 in conducting CSAR missions concluded that the V-22 is between three to seven times as effective depending on the scenario.[180] The report stated that the greater the size of the rescue

[178] Ibid.
[179] Secretary of Defense William S. Cohen, statement before, The House of Representatives Committee on National Security, Washington, D.C., 12 February 1997.
[180] Defense Evaluation and Research Agency, *An Analysis of V-22 and H-60 Effectiveness for the Combat Search and Rescue Mission*, (Arlington, VA.: ANSER Inc., September 1997), p. 55.

demand and the more qualitatively difficult the rescue environment, then the greater the advantage of the V-22.[181]

The V-22's worldwide self-deployability increases its versatility by eliminating the need for strategic lift assets. The V-22 is capable of self-deploying with an Air Expeditionary Force (AEF) and providing immediate CSAR coverage. "This is a major advantage over helicopters, which typically require a degree of disassembly for loading aboard strategic lift aircraft, transport to theater, the need to be reassembled and a test flight before they are operationally available."[182]

Joint Pub 3-50.2 emphasizes the need for flexibility in rescue planning so as to employ resources in the most effective and efficient manner.[183] However, the USAF appendix of this pub states that, "Rescue forces will most likely employ single-ship, night, low-level, terrain masking tactics when conducting CSAR operations."[184] It further states, "that Air Force CSAR forces can conduct effective search operations only in a permissive environment. The vulnerability of rescue resources in a threat environment precludes combat search operations."[185] In order to use the helicopter "effectively and efficiently," rescue planning is limited in scope due to helicopter limitations.

The V-22's versatility will supply the required flexibility to rescue operations. The V-22's higher airspeed, longer unrefueled mission radius and higher service ceiling allow for a greater range of options than helicopters. The ability to employ a launch-from-orbit concept, or accompany a strike package on its mission, allows for an immediate day or night response to a CSAR situation.[186]

"Due to its substantially higher speed and designed-in survivability features, the V-22 has been shown to be three to ten times more survivable than helicopters in every operational effectiveness analysis to date."[187] It is seven to eleven times less vulnerable to small arms fire than current helicopters.[188] Its speed allows for a 50 percent reduction in

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[181] Ibid.
[182] *The V-22 Resource Manual*, p. 2-16.
[183] *Doctrine for Joint Combat Search and Rescue (CSAR)*, Joint Publication 3-05.2, 20 December 1991, p. ix.
[184] Ibid., p. D-2.
[185] Ibid., p. D-3.
[186] Defense Evaluation and Research Agency report, p. 56.
[187] Ibid., p. 2-1.
[188] Major General John E. Rhodes, "The V-22 procurement Rate Problem", *Marine Corps Gazette*, September 1996, Aviation.

en route exposure time and it is 75 percent quieter than current helicopters.[189] Most importantly the V-22 can accelerate and decelerate 40 percent faster than helicopters, which limits the critical exposure time transitioning to and from a hover.[190]

Affordability

Since 1980 when the Office of the Secretary of Defense initiated the Joint Services Advanced Vertical Lift Aircraft Program (JVX), eleven government-sponsored studies and dozens of additional V-22 capabilities analyses have been performed (see chart below).[191] "The V-22 consistently demonstrates the greatest capability for the least cost."[192]

Table 3. V-22 Cost and Operational Effectiveness Studies

DATE	TITLE	AGENCY
1984/1986	Cost and operational effectiveness of the JVX for airlift of special operations forces	ANSER Corp.
1985	An evaluation of the JVX aircraft for the combat search and rescue mission	Center for Naval Analysis (CNA)
1985	An evaluation of the JVX aircraft for the amphibious assault mission	CNA
1987	MV-22 combat effectiveness analysis (Phase I)	BDM Corp.
1990	MV-22 combat effectiveness analysis (Phase II)	BDM Corp.
1990	Assessment of alternatives for the V-22 assault aircraft program	Institute for Defense Analysis
1991	Effectiveness of tiltrotor support to ground combat	Lawrence Livermore National Laboratory
1992	Medium Lift Replacement (MLR) study	Naval Air Systems Command
1993	Cost and Operational Effectiveness Analysis (COEA) for the Advanced Multi-mission Aircraft (MVX)	ANSER Corp.
1994	MLR COEA	CNA
1994	MLR operational effectiveness analysis	BDM Corp.

Source: *The V-22 Resource Manual*

[189] Ibid.
[190] Ibid.
[191] *The V-22 Resource Manual*, p. 2-2.
[192] Ibid.

The enhanced speed and range of the V-22 allow a fewer number of aircraft to accomplish the same mission as a larger helicopter force. For instance a smaller V-22 fleet conducting an amphibious assault can deliver the same amount of troops and equipment as a ten to thirty-five percent larger helicopter force.[193] This smaller sized V-22 fleet equates to reduced manpower requirements and associated costs.

The 1994 Assistant Secretary of the Navy/BDM Corp. COEA concluded, "The V-22's greater speed, designed-in survivability, all weather performance, and advanced defensive avionics and countermeasures will enable it to go in harm's way and perform medical evacuation missions 6 to 15 times more effectively than helicopters."[194] This COEA also determined that the V-22 was three to eleven times more cost effective in this mission than helicopters.[195]

The V-22's ability to self deploy dramatically reduces operational costs. "A 1995 CV-22 (MV-X) COEA showed a relative savings of $6.5 million for a single deployment of eight CV-22s versus eight MH-53J aircraft."[196] The ability of the V-22 to self deploy eliminated the need for four C-5 sorties, twelve C-141 sorties and five MC-130 sorties, which reduced the deployment cost and eliminated the dependence on strategic lift assets.

The *Osprey* was designed with maintenance and support in mind with state-of-the-art avionics, triple redundant digital fly-by-wire flight controls and over forty-three percent of the structural weight of the aircraft composed of composites. That lends itself to a substantially different scheduled maintenance philosophy, reducing maintenance manpower requirements, and thus cost of operation.[197]

There is sufficient information to support the claim that the V-22 is more effective and affordable that helicopters in accomplishing most missions. Additionally, the V-22's versatility increases the cost savings by reducing dependence on fixed wing aircraft. As previously mentioned the ability of the V-22 to self deploy, eliminates the need for strategic lift sorties. Furthermore, the increased range of the V-22 reduces the need for air refueling on operational missions, thereby reducing the number of tanker aircraft

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[193] Ibid., 2-1.
[194] Chart containing 1994 ASN/BDM Corp. COEA data in Congressional Affairs Office, *The V-22 Resource Manual*, (Bell-Boeing , 1997), p. 2-13.
[195] Ibid.
[196] Chart containing 1995 MV-X COEA Supplemental Analysis data in Congressional Affairs Office, *The V-22 Resource Manual*, (Bell-Boeing , 1997), p. 2-16.

required. Additionally, due to the V-22's increased speed and altitude capabilities it can air refuel from KC-10 and KC-135 refueling aircraft. This eliminates the requirement for C-130 tanker aircraft, which are currently required to refuel helicopters.

The Air Force Special Operations Command (AFSOC) will retire a total of eighty-five fixed and rotary-wing aircraft when they receive their fifty V-22s. The versatility of the V-22 allows it to assume the mission of both rotary and fixed wing aircraft. The V-22 will replace the MH-53J Pave Low, MH-60G Pave Hawk and MC-130 Combat Talon I. Furthermore, a percentage of the MC-130P (special operations version of the HC-130) refueling aircraft will be retired due to the decreased requirement for tanker aircraft.[198]

Implications

The V-22 can fly faster, further and higher than current and proposed helicopters. The speed, range and survivability characteristics of the V-22 enhance the probability of mission success. These same characteristics allow a fleet of V-22s to accomplish the same mission as a larger fleet of helicopters, and do it with fewer supporting assets.

Numerous studies have shown that the V-22 is more cost-effective than helicopters. Additionally, worldwide self-deployability, reduced maintenance requirements and reduced dependence on tankers increase the cost effectiveness of the V-22. However, this cost of operation must be weighed against the acquisition cost of the V-22. Currently the estimated cost of the MV-22 (USMC version) is $31 million and the CV-22 (SOF version) is $41 million.[199]

Therefore, while cost is certainly a factor in determining if the USAF should transition its CSAR forces to the V-22, it is not the only factor. If cost was the only factor the USAF should weigh the projected long-term cost savings of a V-22 CSAR fleet against the near-term acquisition cost and choose the cheaper option. However, in

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[197] Ibid., p. 1-20.

[198] AFSOC still has the mission of refueling U.S. Army Special Operations helicopters. Therefore a percentage of MC-130P tanker aircraft must be maintained to accomplish this mission. Since the V-22 can refuel from KC-10, KC-135 and C-130 tankers the requirement for dedicated C-130 tankers is gone. However, this does not mean that the V-22 will not use C-130 refueling aircraft. Therefore, AFSOC will retain a C-130 refueling fleet that is capable of supporting both helicopter and V-22 refueling operations.

[199] Major Jeff Zak, AFSOC/XPQA Hurlburt Field, FL., interviewed by author, 20 February 1998.

determining the best platform to conduct a mission both cost and operational effectiveness must be considered. The decision to replace helicopters with tiltrotors must weigh the merits of operational gains against the cost of these gains.

Chapter 6

Conclusion and recommendations

Conclusion

The genesis of this paper is based on the following concept. The need to recover isolated personnel quickly and reliability raises many policy issues about U.S. combat air search and rescue forces, not the least of which relate to the suitability of their aircraft fleet. Along these lines, this study asks the question of whether the USAF should be satisfied with its helicopter-based CSAR force for the indefinite future, or whether it should make definite plans to replace those helicopters expeditiously with tiltrotor aircraft, probably the Bell-Boeing V-22 *Osprey*.

To answer this question the paper has looked at the role CSAR has played in the Air Force's past, the current and future requirements of USAF CSAR forces, and the impact of speed, range and survivability on the success or failure of rescue operations. Additionally, the proposed benefits and costs of the V-22 were outlined for comparison to current CSAR aircraft.

The purpose of this paper is to inform military planners involved with restructuring the post-Cold War Air Force as to the relative importance of CSAR and the factors to consider in building the CSAR force of tomorrow. Therefore, the emphasis of this paper has dealt with operational considerations affecting the choice between helicopters and tiltrotors. Case studies keyed to operational requirements have been used to determine the effect of speed, range and survivability on CSAR operations.

The Son Tay Prison Raid was a failure in that it did not achieve its stated objective of freeing American POW's. However, it was a success in that it was a perfectly executed plan with incomplete intelligence. If American POW's had been in

the Son Tay camp, they would have been rescued. The helicopter was invaluable in the execution of the mission and its capabilities would have allowed success if POW's were in the camp. However, while the helicopter did not directly cause the failure of the raid on Son Tay, it did increase the complexity of the mission and the potential for failure.

The helicopter's limited range indirectly increased the chance of mission abort/failure by increasing the number of variables that could affect the mission. The helicopters limited unrefueled range increased the number of support aircraft required by necessitating air refueling and thus established a weather requirement that restricted the window of opportunity to conduct the mission to a few days a month.

Additionally, the need to establish a fighter umbrella over the helicopter force also indirectly increased the chance of mission abort/failure by increasing the number of variables that could impact on the mission. If the helicopter force could not get to the Son Tay POW camp and back without being destroyed there was no point in launching the mission. Therefore, to enhance the survivability of the helicopters a fighter umbrella had to be established over the helicopter force.

Finally, if surprise was not achieved the chance of success was low. In order to secure the safety of the POW's, surprise was important to alleviate the possibility of the guards using the POW's as shields or harming them. Surprise was dependent on the ability of the rescue force to arrive undetected and speed was the critical factor in arriving undetected. Speed was crucial to mission success and a fundamental concern in planning the mission. Therefore, speed had a direct effect on the success or failure of the Son Tay mission.

The *Mayaguez* Incident was a success in that the objective of freeing the crew and ship from captivity was achieved. However, the actions of the helicopters and Marines on Koh Tang Island had nothing to do with achieving this objective. Nonetheless, range, speed and survivability factors all had a direct effect on how the assault on Koh Tang Island was conducted. However, speed was the most essential factor in determining to what degree the actions on Koh Tang Island would be a success or a failure.

The effect of the limited range of helicopters reduced the available options and increased the variables involved, thus increasing the chance of mission failure. The CH-53s could stay in the area only a short time before they had to return to U Tapao for fuel.

This limited their ability to wait for a more favorable tactical situation on the island and to be available to assist the ground troops in an emergency. The HH-53, with the ability to air refuel, was able to loiter in the area while waiting for supporting fires from USAF and USN assets. However, depending on air refueling to increase range expands the number of supporting aircraft required and establishes a need for favorable weather conditions.

Survivability concerns affected where and when the Marines were offloaded on the beach and the degree of involvement of supporting fixed-wing aircraft. Additionally, the ability to land the second wave of Marines to stabilize the situation and later to withdraw the Marines was in doubt as aircraft were taken out of action through either being shot down or damaged. Aircraft survivability was an important factor in determining the outcome of the actions on Koh Tang Island.

Speed was the most important factor in determining if the actions on Koh Tang Island would end in success or failure. USMC amphibious doctrine emphasizes a rapid buildup of overwhelming combat power. The slow buildup of combat power on the island affected the Marines efforts to secure the beachhead. Moreover, if not for the arrival of the *USS Coral Sea* in the vicinity of Koh Tang Island around midday and the firepower delivered by fixed-wing aircraft, the cycle time of four hours would have made the evacuation impossible when the decision was made to evacuate the Marines. Speed was essential in both building up combat power on the Island and in evacuating the troops from the island.

The Iranian hostage rescue attempt was aborted when six out of the eight helicopters launched from the *USS Nimitz* could not continue past Desert One. The mission was a complex plan that accepted a high risk of failure. The effects of speed, range and survivability on the helicopter operations drove the complexity of the air plan, in part.

The necessity for a refueling operation at Desert One was driven by the range limitations of the helicopter. With a single fuel load the helicopters were incapable of flying from the *USS Nimitz*, in the Gulf of Oman, with the assault force onboard to Desert Two, moving to the hide sites and transporting the hostages and the rescuers to

Manzariyeh airfield the next night. Range was an important factor in determining the probability of success or failure in this mission.

The plan to hide the helicopters in the hills around Garmsar was required due to the speed limitations of the helicopters. The assault force required the element of surprise in order for their plan to work. Therefore, their arrival at Desert Two and the hiding of the helicopters had to be accomplished prior to sunrise to minimize the risk of discovery. The helicopters did not have the speed required to transport the assault force to Desert Two and depart the country before sunrise.

The need to conduct the first night's events during the hours of darkness was an important factor in determining the timing of the mission. A number of seasonal weather conditions, to include the available hours of darkness, would have turned against the mission if it were delayed. Therefore, the speed limitation of the helicopter not only drove the requirement to hide the helicopters inside of Iran but also was a factor in determining the timing of the operation.

The speed and distance limitations of the helicopter drove the requirement for Desert One and the hide sites. Survivability concerns forced the helicopters to fly low level and into the worst part of the dust cloud. The effects of speed, range and survivability were important factors that contributed to the complexity and ultimate failure of this mission.

The case studies indicate that in varying degrees both the planning and probability of success of rescue missions are influenced by the effects of speed, range and survivability. From a strict operational viewpoint, an aircraft that has increased speed, range and survivability would be more flexible and capable in the CSAR mission.

The cost-benefit overview of the V-22 indicates that it is conceivable that a CSAR fleet of tiltrotor aircraft would yield long-term cost savings over a helicopter and C-130 based fleet. The USAF must weighed the projected long-term cost savings of a tiltrotor CSAR fleet against the near-term acquisition cost to determine the actual cost basis of a Tiltrotor based CSAR fleet.

Global Engagement, the Air Force vision for the 21st century, calls for an agile, fast, global ranged Air Force capable of conducting operations from CONUS bases. Therefore, the anticipated requirements of tomorrow would favor an aircraft that had the

ability to fly faster, further and higher. Furthermore, a CSAR fleet of tiltrotors, with their ability to rapidly self-deploy, would more readily support the Air Force's Air Expeditionary Force (AEF) concept that is currently being utilized.

Recommendations

The historical record indicates that speed, range and survivability are important factors in the planning, execution and success of rescue missions. Since there is no challenge to a tiltrotor's greater speed and range by current or proposed helicopters, it appears to be the best platform based on operational concerns. While the Commanche claims to have increased survivability through the use of stealth technology its speed and range are comparable with current helicopters. Furthermore, since CSAR is a 24-hour a day mission, the benefits gained by stealth technology on a low flying helicopter during daylight hours might not justify the cost. Most importantly, the case studies indicate that speed is the dominant variable in rescue operations and only a tiltrotor can overcome the theoretical limits imposed on rotary-wing aerodynamics by the laws of physics.

However, cost will be a factor in determining the rescue fleet of tomorrow and therefore a comprehensive cost-benefit analysis is justified. Ultimately, a mixed fleet of helicopters and tiltrotors might be the most cost effective option: helicopters to cover some missions at reduced cost: tiltrotors to cover certain difficult and high-value missions with greater effectiveness. Therefore, a need exists for technological and operational trade-off studies of tiltrotors, current helicopters and proposed helicopters such as the stealthy Commanche for filling the CSAR requirements in the future.

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